

## PATENT ABSTRACTS OF JAPAN

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## (54) FLAME RETARDANT POLYAMIDE COMPOSITION AND USE THEREOF

## (57)Abstract:

PROBLEM TO BE SOLVED: To obtain a flame retardant polyamide composition excellent in flame retardance and further mechanical characteristics such as toughness, good in fluidity and suitably usable for applications to electrical and electronic parts and the electrical and electronic parts formed by using the flame retardant polyamide composition, excellent in flame retardance and heat resistance and excellent even in mechanical characteristics.

SOLUTION: This flame retardant polyamide composition is characterized as comprising (A) 20-80 pts.wt. of an aromatic polyamide, (B) 5-50 pts.wt. of an inorganic reinforcing material, (C) 5-40 pts.wt. of a polybrominated styrene and (D) 0.1-10 pts.wt. of a compound containing antimony and/or a compound oxide containing zinc [with the proviso that the sum of the components (A), (B), (C) and (D) is 100 pts.wt.].

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CLAIMS

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[Claim(s)]

[Claim 1] Aromatic polyamide to which MFR measured with the load of 2.16kg and the melting point of +10 degrees C is in the range for 40-300g / 10 minutes, and the melting point exceeds 290 degrees C : (A) 20 - 80 weight section, (B) -- minerals reinforcement: -- 5 - 50 weight section and MFR by which (C) bromine content is measured at 3.8kg of loads and 230 degrees C 44 to 61% of the weight with Pori bromination styrene: 5 - 40 weight section for 70 - 300g / 10 minutes (D) The compound containing antimony, and/or fire-resistant polyamide constituent characterized by consisting of multiple oxide: 0.1 containing zinc - the 10 weight sections (however, the sum total of the above (A), (B), (C), and the (D) component being the 100 weight sections).

[Claim 2] The fire-resistant polyamide constituent given in the 1st term of a claim characterized by the viscosity number measured about the polyamide extracted from the above-mentioned fire-resistant polyamide constituent using concentrated sulfuric acid being in the range of 60-110ml/g.

[Claim 3] Fire-resistant electrical and electric equipment and electronic parts characterized by being formed in either claim 1 or claim 2 from the fire-resistant polyamide constituent of a publication.

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DETAILED DESCRIPTION

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## [Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the electrical and electric equipment and electronic parts formed from a fire-resistant polyamide constituent and this fire-resistant polyamide constituent. In detail, this invention relates to the electrical and electric equipment and electronic parts excellent in the thermal resistance formed from the fire-resistant polyamide constituent excellent in the suitable \*\*\*\* fluidity to manufacture the electrical and electric equipment and electronic parts, such as a connector of \*\*\*\*, in a \*\* pitch, and this polyamide constituent.

[0002]

[Background of the Invention] This invention relates to the electrical and electric equipment and electronic parts like the connector formed from the fire-resistant polyamide constituent excellent in reflow thermal resistance, and this fire-resistant polyamide constituent while it is excellent in machine physical properties, such as a fluidity and toughness. Especially this invention relates to the electrical and electric equipment and electronic parts like the connector excellent in the thermal resistance formed from the fire-resistant polyamide constituent suitable for forming the electrical and electric equipment and electronic parts, such as a fine pitch connector with a short distance between connector terminals, with thin meat, and this fire-resistant polyamide constituent in more detail.

[0003]

[Background of the Invention] soldering of the connectors to a former and printed circuit board top -- a DIP (immersion) -- it was carried out by law. However, reflow (surface mount) soldering was developed as an approach of performing mounting of high density in recent years. This paints cream-like solder on a printed wired board using a printing technique, and is on this painted cream-like pewter. It is the approach of carrying out a surface mount with the pewter which fused components, such as a connector which laid components, such as a connector, was made to heat and carry out melting of the cream-like solder, and subsequently laid it with infrared radiation and/or hot blast heating. When such a reflow-soldering method is adopted, since a surface mounted device is exposed to a no less than 230-240 degrees C elevated temperature by infrared radiation or hot blast all over a reflow furnace, high thermal resistance is needed for the connector ingredient for surface mounts.

[0004] Heating fusion is carried out as a material which forms electronic parts from the former, and the polyamide which can be fabricated in a predetermined configuration is used. Generally, as a polyamide, although 6 nylon, 66 nylon, etc. are used extensively, although such a fat group polyamide has a good moldability, it does not have thermal resistance sufficient as a raw material for manufacturing the surface mounted device exposed to the above elevated temperatures. The demand of the polyamide which has high thermal resistance from such a background increased, and 46 nylon was developed. Although this had thermal resistance higher than 6 nylon and 66 nylon, it had the fault that water absorption was also high. Therefore, the electrical and electric equipment and electronic parts fabricated using 46 Nylon constituent had the problem of a blister (blister) occurring with heating at the time of a reflow, when the dimension might change with water absorption and the Plastic solid had absorbed water. On the other hand, the aromatic polyamide (refer to JP,59-53536,A) guided from aromatic series dicarboxylic acid and aliphatic series alkylene diamines, such as a terephthalic acid, was developed. Compared with aliphatic series polyamides, such as 66 nylon and 46 nylon, it this is not only further excellent in thermal resistance, a mechanical strength, and rigidity, but has the description that water absorption is also low.

[0005] Although polyamide resin is originally self-extinguishing, it is necessary to blend a flame retarder with the surface mounted device as which the high fire retardancy of V-0 specified by UL94 is required. It is the constituent (refer to JP,51-47034,A) with which the approach of adding flameproofing agents, such as a halogenated compound, to a polyamide is generally learned, for example, halogenation polystyrene was added by the polyamide, for example, ferro company make -- the constituent (refer to JP,3-66755,A) with which the bromination polystyrene which is represented by PAIRO check 68PB, and which brominates polystyrene and is obtained was added, and bromination polystyrene excel in thermal stability, and the constituent (refer to JP,5-320503,A and WO 98/No. 14510 official report) with which the Pori bromination styrene obtained by carrying out the polymerization of the bromination styrene was added, or the constituent (refer to JP,56-2100,A) with which the condensation product of a bromine-ized phenol was added by the polyamide are known.

[0006] In recent years, not only high toughness but thermal resistance with the expensive resin with which surface mounted devices, such as a connector, are used for this application since thinning and \*\* pitch-ization are progressing, and a high fluidity were required. This is because a high fluidity is required, in order to fabricate the connector of a minute configuration. For this reason, it excels in fire retardancy and a surface mounted device application like a connector is expected the appearance of a fire-resistant polyamide constituent with a high fluidity with sufficient toughness.

[0007] As a result of inquiring wholeheartedly in view of such a situation, this invention person excels [ constituent / containing specific aromatic polyamide and the Pori bromination styrene which has a specific bromine content and specific MFR / polyamide ] in fire retardancy, and came to complete a header and this invention with the sufficient fluidity for toughness being high and it being suitable for the electrical and electric equipment and an electronic-parts application.

[0008]

[Objects of the Invention] This invention is excellent in fire retardancy, its fluidity is good, and it aims at offering a fire-resistant polyamide constituent with high toughness. Moreover, this invention aims at offering the electrical and electric equipment and electronic parts excellent in the fire retardancy and thermal resistance which were formed using the above fire-resistant polyamide constituents.

[0009]

[Summary of the Invention] Aromatic polyamide to which the fire-resistant polyamide constituent of this invention has MFR measured with the (A) load of 2.16kg, and the melting point of +10 degrees C in the range for 40 - 300g / 10 minutes, and the melting point exceeds 290 degrees C: It is 20 - 80 weight section, (B) -- minerals reinforcement: -- 5 - 50 weight section and MFR by which (C) bromine content is measured at 3.8kg of loads and 230 degrees C 44 to 61% of the weight with Pori bromination styrene:5 - 40 weight section for 70 - 300g / 10 minutes (D) It is characterized by consisting of multiple oxide:0.1 containing the compound containing antimony, and/or zinc - the 10 weight sections (however, the sum total of the above (A), (B), (C), and the (D) component being the 100 weight sections).

[0010] As for such a fire-resistant polyamide constituent of this invention, it is also desirable that the viscosity number measured about the polyamide extracted from this constituent using concentrated sulfuric acid is in the range of 60-110ml/g. Moreover, the fire-resistant electrical and electric equipment and electronic parts of this invention are characterized by being formed from the fire-resistant polyamide constituent of above-mentioned this invention.

[0011]

[Detailed Description of the Invention] Hereafter, this invention is explained concretely.

The fire-resistant polyamide constituent of <fire-resistant polyamide constituent> this invention, Aromatic polyamide to which MFR measured with the load of 2.16kg and the melting point of +10 degrees C is in the range for 40-300g / 10 minutes, and the melting point exceeds 290 degrees C : (A) 20 - 80 weight section, (B) -- minerals reinforcement: -- 5 - 50 weight section and MFR by which (C) bromine content is measured at 3.8kg of loads and 230 degrees C 44 to 61% of the weight with Pori bromination styrene:5 - 40 weight section for 70 - 300g / 10 minutes (D) It consists of multiple oxide:0.1 containing the compound containing antimony, and/or zinc - the 10 weight sections (however, the sum total of the above (A), (B), (C), and the (D) component is the 100 weight sections).

[0012] Hereafter, each component which constitutes the fire-resistant polyamide constituent of this invention is explained.

(A) The aromatic polyamide (A) which constitutes the fire-resistant polyamide constituent of aromatic polyamide this invention is aromatic polyamide to which MFR measured with the load of 2.16kg and the melting point of +10 degrees C is in the range for 40 - 300g / 10 minutes, and the melting point exceeds 290 degrees C.

[0013] (A) Aromatic polyamide is (i). It is formed from the repeating unit guided from dicarboxylic acid and (ii) diamine. (i) dicarboxylic acid which forms (A) aromatic polyamide used by this invention contains aromatic series dicarboxylic acid as an indispensable component, and is desirable as aromatic series dicarboxylic acid (i-a). The terephthalic acid is contained.

[0014] Moreover, this (i) dicarboxylic acid may contain aliphatic series dicarboxylic acid in aromatic series dicarboxylic acid pans (i-c) other than a terephthalic acid (i-b). (i-b) As aromatic series dicarboxylic acid other than a terephthalic acid, isophthalic acid, 2-methyl terephthalic acid, naphthalene dicarboxylic acid, these combination, etc. are mentioned, for example.

[0015] (i-c) As aliphatic series dicarboxylic acid, concretely, the carbon atomic numbers 4-20 and the aliphatic series dicarboxylic acid which has the alkylene group of 6-12 preferably are mentioned, for example, a succinic acid, an adipic acid, an azelaic acid, sebacic acids, these combination, etc. are mentioned. Among these, an adipic acid is desirable. As (i) dicarboxylic acid component unit which constitutes (A) aromatic polyamide used by this invention, the dicarboxylic acid component unit guided from a terephthalic acid -- % and 30-100-mol having in 50-100-mol% of amount within the limits preferably -- desirable -- aromatic series dicarboxylic acid other than a terephthalic-acid (i-b) component unit and/or (i-c) the carbon atomic numbers 4-20, and the configuration unit preferably guided from the aliphatic series dicarboxylic acid of 6-12 -- 0-70-mol % -- it can contain in % of the amount of 0-50 mols preferably.

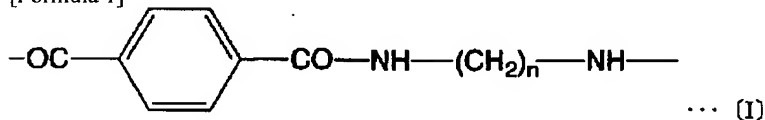
[0016] moreover -- as (ii) diamine component unit which forms this (A) aromatic polyamide with the above-mentioned dicarboxylic acid component -- the carbon atomic numbers 4-20 -- desirable -- the straight chain alkylene diamine and/or the side-chain alkyl group of 6-12 - - having -- the carbon atomic numbers 4-20 -- the alkylene diamine of 6-12 and alicycle group diamine are mentioned preferably. among these -- as an alkylene diamine component unit -- the carbon atomic numbers 4-18 and the carbon atomic numbers 4-18 which have the straight chain alkylene diamine and/or the side-chain alkyl group of 6-12 preferably -- the alkylene diamine component unit of 6-12 is mentioned preferably.

[0017] As the straight chain alkylene diamine of the carbon atomic numbers 4-18, Concretely, 1,4-diaminobutane, 1, 6-diaminohexan, 1, 7-diamino heptane, 1, 8-diamino octane, 1, 9-diamino nonane, 1, 10-diamino decane, 1, and 11-diamino undecane, 1, 12-diamino dodecane, 2-methyl-1,5-diaminopentane, the 2-methyl -1, 8-diamino octanes, these combination, etc. are mentioned. Among these, 1, 6-diaminohexan, 1, 9-diamino nonane, 1, and 10-diamino decane are desirable, and 1 and 6-diaminohexan is especially desirable.

[0018] Moreover, a cyclohexanediamine can be mentioned as an example of alicycle group diamine. As an example of a repeating unit which consists of a terephthalic-acid component unit and aliphatic series diamine, the repeating unit expressed with a degree type [I] can be mentioned.

[0019]

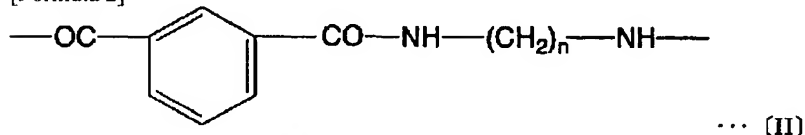
[Formula 1]



[0020] however, the above-mentioned formula -- setting -- n -- 4-20 -- it is 6-12 preferably. Moreover, the repeating unit expressed with a degree type [II] can be mentioned as a suitable repeating unit which can form the polyamide of this invention with the repeating unit expressed with the above-mentioned formula [I].

[0021]

[Formula 2]



[0022] however, the above-mentioned formula [II] -- setting -- n -- the above-mentioned formula [I] -- independent -- 4-20 -- it is 6-12 preferably. Furthermore, the repeating unit expressed with a degree type [III] can be mentioned as a suitable repeating unit which can form the polyamide of this invention with the repeating unit expressed with the above-mentioned formula [I].

[0023]

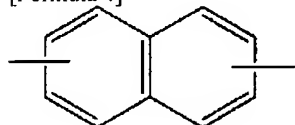
[Formula 3]



[0024] however, the annular radical as which R1 and R2 are independently expressed in the following formula in the above-mentioned formula [III], respectively or the carbon atomic numbers 4-20 -- it is the hydrocarbon group of the bivalence of 6-12 etc. preferably. And in the above R1 and R2, it is desirable for either and the component unit which consists of dicarboxylic acid preferably to be the radicals of R1 and R2 which have the following cyclic structures at least. moreover, the radical on which a dicarboxylic acid component unit usually has cyclic structure although R1 and R2 may be radicals on which both have the following cyclic structure in the above [III] -- it is -- another side -- usually -- a diamine component unit -- the carbon atomic numbers 4-20 -- you may be the hydrocarbon group of the bivalence of 6-12 preferably. In this case, a diamine component unit may be the diamine which has the carbon atomic numbers 4-20 and desirable alicycle structure [ like a cyclohexanediamine ] whose hydrocarbon group of the bivalence of 6-12 is. further -- again -- both -- the carbon atomic numbers 4-18 -- you may be the hydrocarbon group of the bivalence of 6-12 preferably. In addition, as for the hydrogen atom combined with the carbon atom which forms the cyclic structure of the radical which has the cyclic structure of bivalence as shown below, at least the part may be permuted by the atom of monovalence, such as alkyl groups, such as a methyl group and an ethyl group, a radical of other monovalence, and a halogen atom.

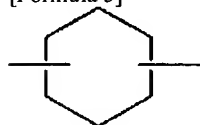
[0025]

[Formula 4]



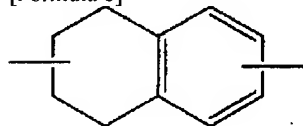
[0026]

[Formula 5]



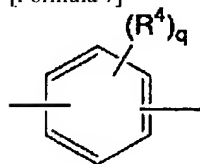
[0027]

[Formula 6]



[0028]

[Formula 7]



[0029] However, R4 is the alkyl group of a hydrogen atom or the carbon atomic numbers 1-5, and q is the integer of 1-4. As mentioned above, (A) aromatic polyamide used by this invention has the repeat unit guided from the dicarboxylic acid containing the above terephthalic acids, and diamine. and the aromatic series dicarboxylic acid units and/or aliphatic series dicarboxylic acid units other than the terephthalic acid [ amount / of the terephthalic-acid component unit in the dicarboxylic acid component unit which constitutes (A) aromatic polyamide ] in a 30 - 100-mol % and dicarboxylic acid [ which is in 50 - 100 mol% of within the limits preferably, and constitutes (A) aromatic polyamide ] component unit -- 0 - 70-mol % -- it contains in 0 - 50-mol% of amount within the limits preferably.

[0030] And it is a time of making into 100-mol % suitably the configuration unit guided from dicarboxylic acid, The configuration unit (a) guided from a terephthalic acid 30 - 100-mol %, It contains at 50-70-mol % preferably [ it is desirable and ] in a 40-80 mol % pan. The configuration unit (b) guided from aromatic series dicarboxylic acid other than a terephthalic acid It contains in % of the amount of 0-20 mols still more preferably. 0-50-mol % -- desirable -- 0-40-mol % -- It is desirable to contain preferably [ it is desirable and ] the configuration unit (c) guided from aliphatic series dicarboxylic acid at 30 - 50-mol % in a 20-60 mol % pan 0 - 70-mol%.

[0031] Moreover, (A) aromatic polyamide used by this invention requires that MFR measured on 2.16kg of loads and conditions with a melting point of +10 degrees C should be within the limits of 40 - 300g / 10 minutes, it is desirable that this MFR is within the limits of 50 - 250g / 10 minutes, and especially its thing to be within the limits of 200g / [ further 60 - ] 10 minutes is still more desirable.

[0032] MFR measured [ especially ] by this invention-with the melting point of +10 degrees C of the above-mentioned (A) aromatic polyamide is 40-300g / specific (A) aromatic polyamide that has 10 minutes within the limits of 50 - 250g / 10 minutes preferably, By

combining specific (C) Pori bromination styrene which has 3.8kg of loads, and MFR measured at 230 degrees C within the limits of 70-300g / 10 minutes and which is mentioned later, a fluidity is very good, thermal resistance is high, and the fire-resistant polyamide constituent excellent in the mechanical property can be obtained.

[0033] The above (A) aromatic polyamide has the high melting point, and the melting point is usually over 290 degrees C. It has the thermal resistance in which especially the aromatic polyamide 295-330 degrees C of whose melting points are 300-320 degrees C preferably was excellent also among the aromatic polyamide which has such the melting point. Furthermore, the glass transition temperature in the amorphism section of (A) aromatic polyamide is usually 80 degrees C or more.

[0034] Moreover, since such aromatic polyamide has specific structure as mentioned above, it shows a value low also about absorptivity. (A) aromatic polyamide used by this invention is excellent in thermal resistance, and 280-380 degrees C of working temperature at the time of compounding and shaping are usually 300-350 degrees C preferably.

[0035] In the fire-resistant polyamide constituent of this invention, the above aromatic polyamide can also use independently a presentation, MFR, and the aromatic series diamine that has the melting point in above-mentioned within the limits, and can use it combining two or more aromatic polyamide from which a property differs further. When using two or more aromatic polyamide, an aromatic polyamide class, loadings, etc. which are used so that the property of the blended whole aromatic polyamide may become above-mentioned within the limits can be adjusted.

[0036] As for the above (A) aromatic polyamide, it is desirable in the fire-resistant polyamide constituent of this invention to usually contain in 25 - 70% of the weight of an amount preferably 20 to 80% of the weight to the total quantity of the multiple oxide containing the compound containing (A) aromatic polyamide which constitutes the fire-resistant polyamide constituent of this invention, (B) minerals reinforcement, (C) Pori bromination styrene, and (D) antimony, and/or zinc.

[0037] (B) The fire-resistant polyamide constituent of minerals reinforcement this invention contains (B) minerals reinforcement. At this invention, it is minerals reinforcement. The various inorganic fillers which have configurations, such as the shape of fibrous, powder, a grain, tabular, a needle, the letter of a cross, and a mat, can be used. If it furthermore explains in full detail, as minerals reinforcement, inorganic fibers, such as a glass fiber (glass fiber), a potassium titanate fiber, a metallic-coating glass fiber, ceramic fiber, wollastonite, a carbon fiber, metallic carbide fiber, metal hardened material fiber, an asbestos fiber, and boron fiber, will be mentioned. Especially as such a fibrous bulking agent, a glass fiber is desirable. While the moldability of a constituent improves by using a glass fiber, heat-resistant properties, such as mechanical properties, such as tensile strength of the Plastic solid formed from a thermoplastics constituent, flexural strength, and a bending elastic modulus, and heat deflection temperature, improve. the above average die length of a glass fiber -- usually -- 0.1-20mm -- desirable -- the range of 0.3-6mm -- it is -- an aspect ratio -- usually -- 10-2000 -- it is in the range of 30-600 preferably. It is desirable to use the glass fiber which has average die length and an aspect ratio in such within the limits. When using such a glass fiber as a (B) minerals bulking agent in the fire-resistant polyamide constituent of this invention, it is usually preferably blended in 10 - 40% of the weight of an amount with 5 - 50% of the weight of an amount to a total of 100 weight sections of (A), (B), (C), and the (D) component.

[0038] As the example of the various minerals reinforcement which have configurations, such as the shape of minerals reinforcement other than the fibrous minerals reinforcement used as the above-mentioned minerals reinforcement, i.e., powder, a grain, tabular, a needle, the letter of a cross, and a mat Needlelike inorganic compounds, such as an inorganic compound powdery [ such as \*\* a silica, a silica alumina, an alumina, a calcium carbonate, a titanium dioxide, talc, straw SUTONAITO, the diatom earth, clay, a kaolin, spherical glass, a mica, gypsum, red ochre, magnesium oxide, and a zinc oxide, ] or tabular and potassium titanate, can be mentioned.

[0039] These minerals reinforcement may be used independently, may be combined two or more sorts and may be used. Moreover, these minerals reinforcement can also be processed and used by the silane coupling agent or the titanium coupling agent. For example, surface treatment may be carried out with silane system compounds, such as vinyltriethoxysilane, 2-aminopropyl triethoxysilane, and 2-glycidioxy propyltriethoxysilane. In addition, when such minerals reinforcement are granular objects, as for the mean particle diameter, it is desirable for there to be usually 0.1-200 micrometers within the limits of 1-100 micrometers preferably.

[0040] In this invention, glass fiber is preferably used also in the minerals reinforcement mentioned above. As for the above (B) minerals reinforcement, it is desirable in the fire-resistant polyamide constituent of this invention to usually contain in 10 - 45% of the weight of an amount preferably five to 50% of the weight to the total quantity of the multiple oxide containing the compound containing (A) aromatic polyamide which constitutes the fire-resistant polyamide constituent of this invention, (B) minerals reinforcement, (C) Pori bromination styrene, and (D) antimony, and/or zinc.

[0041] (C) The fire-resistant polyamide constituent of Pori bromination styrene this invention contains (C) Pori bromination styrene. In this invention, as (C) Pori bromination styrene, you may manufacture by carrying out the polymerization of bromination styrene or the bromination alpha methyl styrene, and you may be bromination polystyrene manufactured by brominating polystyrene or Pori alpha methyl styrene, and these both are included.

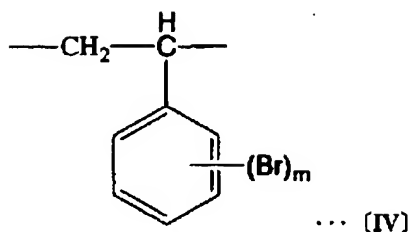
[0042] Specifically as such (C) Pori bromination styrene, poly dibromo styrene, PORITORI bromostyrene, the poly PENTA bromostyrene, poly TORIBUROMO alpha methyl styrene, etc. are mentioned. It is desirable to use the Pori bromination styrene manufactured by carrying out the polymerization of the bromination styrene or bromination alpha methyl styrene beforehand brominated [ especially ] in the phase of a monomer by this invention. Thus, the Pori bromination styrene which is made to carry out a polymerization and is obtained after brominating a part of hydrogen atom [ at least ] which forms the aromatic series ring of the styrene which is a raw material monomer, or alpha methyl styrene is permuted by the hydrogen atom combined with the carbon atom with which a bromine atom forms an aromatic series ring, it exists in a polymer and the hydrogen atom which forms the alkyl chain which makes the main frame of this polymer is not substantially permuted by the bromine atom.

[0043] On the other hand, after carrying out polymerization generation of the polystyrene etc., using styrene or alpha methyl styrene as a raw material, although a part of hydrogen atom which mainly combined the bromination polystyrene brominated and obtained with the carbon atom which forms an aromatic series ring is permuted by the bromine atom, a part of hydrogen atom which forms the alkyl chain which makes the main frame of a polymer is permuted by the bromine atom. Both differ in respect of whether it has permuted by the hydrogen atom in which a bromine atom forms the alkyl chain which makes the main frame of a polymer.

[0044] However, if both express with a formula, generally they are expressed with following [IV].

[0045]

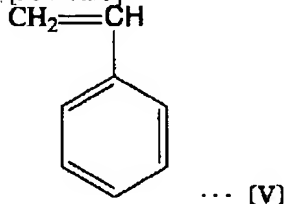
[Formula 8]



[0046] Here, m is the integer of 1-5. That is, bromination polystyrene is brominated after carrying out the polymerization of the styrene expressed with the following type [V] as a raw material.

[0047]

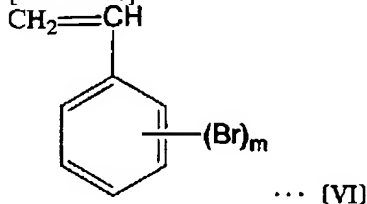
[Formula 9]



[0048] On the other hand, Pori bromination styrene is obtained by carrying out the polymerization of the bromination styrene expressed with the following type [VI].

[0049]

[Formula 10]



[0050] Among these (C) Pori bromination styrene, after brominating a monomer beforehand in this invention, it is desirable to use the Pori bromination styrene which carried out the polymerization. MFR by which a bromine content is 54 - 61 % of the weight preferably 44 to 61% of the weight, and (C) Pori bromination styrene used by this invention is measured at 2.095mm of orifice bores, 3.8kg of loads, and 230 degrees C -- 70-300 -- it is preferably desirable 70-200, and that it is 80-150 more preferably. or weight average molecular weight (Mw) -- 2,000-100,000 -- it is desirable preferably 5,000-80,000, and that it is 8,000-60,000 still more preferably.

[0051] When the inside of the fire-resistant polyamide constituent of this invention contains such (C) Pori bromination styrene, it is excellent in especially fire retardancy, and excellent also in a \*\*\*\* fluidity. the inside of the fire-resistant polyamide constituent of this invention -- setting -- above (C) Pori -- bromination -- as for styrene, it is desirable to usually contain in 10 - 45% of the weight of an amount preferably five to 50% of the weight to the total quantity of the multiple oxide containing the compound containing (A) aromatic polyamide which constitutes the fire-resistant polyamide constituent of this invention, (B) minerals reinforcement, (C) Pori bromination styrene, and (D) antimony, and/or zinc.

[0052] (D) As an example of the compound containing the antimony used as a (D) component by multiple oxide this invention containing the compound/zinc containing antimony, an antimony trioxide, antimony pentoxide, antimony tetroxide, sodium antimonate, etc. are mentioned. Moreover, it is an example of the multiple oxide containing the zinc similarly used as a (D) component, the following -- a formula -- two -- ZnO - three -- B-2 -- O -- three -- four -- ZnO - B-2 -- O -- three - H -- two -- O -- two -- ZnO - three -- B-2 -- O -- 3.3.5 -- H -- two -- O -- expressing -- having -- a boric acid -- zinc -- a formula -- ZnSnO -- three -- ZnSn -- (-- OH --) -- six -- expressing -- having -- stannic acid -- zinc -- etc. -- a molybdic acid -- calcium -- zinc -- basicity -- a molybdic acid -- zinc -- high -- efficiency -- a molybdic acid -- zinc -- a magnesium silicate -- a compound -- zinc phosphate -- etc. etc. -- mentioning -- having .

[0053] The multiple oxide containing the compound containing such antimony and zinc can be used combining the multiple oxide containing the compound which can use it independently and contains two or more antimony, or two or more zinc. Furthermore, it can also be used combining the compound containing antimony, and the multiple oxide containing zinc. Moreover, the compound containing antimony and the multiple oxide containing zinc can also be used together. Among these, sodium antimonate, 2ZnO(s) and 3 B-2s O3, and those combination are used preferably.

[0054] Fire retardancy of a (D) component [ such ] improves by using together with (C) Pori bromination styrene. It is usually 1 - 8% of the weight of an amount preferably 0.1 to 10% of the weight to the total quantity of the multiple oxide which contains the compound with which the above (D) components contain (A) aromatic polyamide, (B) minerals reinforcement, (C) Pori bromination styrene, and (D) antimony, and/or zinc in the fire-resistant polyamide constituent of this invention.

[0055] The fire-resistant polyamide constituent of other component this inventions may contain compounding agents, such as inorganic compounds, such as heat-resistant stabilizers other than the above, a weathering stabilizer, a plasticizer, a thickener, an antistatic agent, a release agent, a pigment, a color, inorganic or an organic bulking agent, a nucleating additive, a fiber reinforcing agent, carbon black, talc, clay, and a mica, in the range which does not spoil the purpose of this invention in addition to each above component.

[0056] Thermal resistance, fire retardancy, rigidity, tensile strength, flexural strength, and impact strength of the fire-resistant polyamide constituent [ especially ] of this invention improve further by containing the fiber reinforcing agent among the above. Furthermore, the fire-

resistant polyamide constituent of this invention may contain other polymers in the range which does not spoil the purpose of this invention, and is an example of such other polymers, Polyethylene, polypropylene, Pori 4-methyl -1 - Polyolefines, such as a pentene, ethylene and 1-butene copolymer, a propylene ethylene copolymer, a propylene and 1-butene copolymer, and a polyolefine elastomer, polystyrene, a polyamide, a polycarbonate, polyacetal, polysulfone, polyphenylene oxide, a fluororesin, silicone resin, etc. are mentioned.

[0057] Moreover, the fire-resistant polyamide constituent of this invention may contain bromine system flame retarders other than the Pori bromination styrene (above-mentioned [ C ]). The following bromine compounds are mentioned as such a bromine system flame retarder. Hexabromobenzene, penta-bromoethyl benzene, hexabromobiphenyl, deca BUROMO diphenyl, hexa BUROMO diphenyloxide, OKUTABUROMO diphenyloxide, deca BUROMO diphenyloxide, tetrabromobisphenol A, and tetrabromobisphenol A-screw (hydroxy ethyl ether), A tetrabromobisphenol A-screw (2, 3-dibromopropyl ether), Tetrabromobisphenol A derivatives, such as a tetrabromobisphenol A-screw (BUROMO ethyl ether) and a tetrabromobisphenol A-screw (allyl compound ether), The tetrabromo bisphenol S and a tetrabromo bisphenol S-screw (hydroxy ethyl ether), Tetrabromo bisphenol S derivatives, such as a tetrabromo bisphenol S-screw (2, 3-dibromopropyl ether), Tetrabromo phthalic anhydride derivatives, such as tetrabromo phthalic anhydride, a tetrabromo phthalimide, and an ethylene bis-tetrabromo phthalimide, An ethylene screw (5, 6-dibromo norbornane - 2 three - dicarboxyimide), Tris - (2, 3-dibromopropyl -1)- Isocyanurate, the Diels-Alder addition product of a hexa BUROMO cyclopentadiene, TORIBUROMO phenyl glycidyl ether, TORIBUROMO phenyl acrylate, Ethylene Bisto RIBUROMO phenyl ether, ethylene bis-pentabromophenyl, The ethylene bis-pentabromophenyl ether, tetra-DEKABUROMOJI phenoxy benzene, Bromination polyphenylene oxide, a bromination epoxy resin, a bromination polycarbonate, Poly PENTABUROMO benzyl acrylate, OKUTABUROMO naphthalene, a pen TABUROMO cyclohexane, a hexa BUROMO cyclo dodecane, a screw (TORIBUROMO phenyl) fumaric amide, N-methyl hexa BUROMO diphenylamine, etc.

[0058] The viscosity number measured about the above (A) component, (B) component, and (C) component and (D) component and the polyamide which contained other components as occasion demands further, and was extracted using concentrated sulfuric acid is 60-110ml/g, and, as for the fire-resistant polyamide constituent of constituent this invention, it is desirable that it is 70 - 105 ml/g preferably.

[0059] In this invention, a viscosity number is the value measured based on ISO 307-1984(E), extracts a polyamide from the fire-resistant polyamide constituent of this invention using concentrated sulfuric acid 96%, and, specifically, prepares the concentrated-sulfuric-acid solution of the polyamide which contains a polyamide by the concentration of 0.005g/ml. In this way, it is the value which measured and asked ISO 3105 for the viscosity in 25 degrees C using the viscometer of the Ubbelode mold of a publication about the obtained solution.

[0060] Moreover, as for the fire-resistant polyamide constituent of this invention, it is desirable for the fire retardancy evaluated by the UL94 convention to be about [ V-0 ]. Fire-resistant evaluation by UL94 convention is performed as follows here. The upper limit section of a test piece is stopped to a testing device by the clamp, and a test piece is set perpendicularly. After applying predetermined flame to the lower limit section of this test piece for 10 seconds, flame is released and the first burn time of a test piece is measured.

[0061] If the combustion in the first combustion test of a test piece stops (fire extinguishing), after applying flame for 10 seconds from the lower limit section immediately, flame is released and the burn time of the two-times eye of a trial affair is measured. Maximum is set to M among ten data, and the sum total is set to T. From this result, the following criteria estimate fire retardancy.

About [ V-0 ]: For 10 or less seconds and T, M is about [ V-0 ], if the cotton with which it is 50 or less seconds, and a test piece did not blaze up to the clamp, but melt fell, and it covered downward is not ignited.

[0062] This [ V-plane 1 ]: If T takes [ M ] 30 or less seconds in 250 or less seconds, prejudice does not blaze up to a clamp and melt does not ignite lower cotton, it is [ this / V-plane 1 ].

About [ V-2 ]: When T does not blaze up in 30 or less seconds, and a test piece does not blaze up [ M ] to a clamp in 250 or less seconds, but melt falls and lower cotton is ignited, it is about [ V-2 ].

In this invention, by mainly using Pori bromination styrene as a flame retarder, a flame retarder forms a very fine particle into aromatic polyamide, and distributes to homogeneity very much. For this reason, the fire-resistant polyamide constituent of this invention is suitable as flame retardant resin for excelling also in a \*\*\*\* fluidity, and a good moldability being shown, and forming the finized electrical and electric equipment and electronic parts, especially the electron and electrical part which have the structure which a detailed terminal fits in like a connector while it has good fire retardancy.

[0063] Moreover, such a fire-resistant polyamide constituent of this invention has low absorptivity, and since the Plastic solid which fabricates this constituent and is acquired is excellent also in mechanical properties, such as toughness, it is especially suitable [ Plastic solid ] for it for the electrical and electric equipment and an electronic-parts application, while excelling in a moldability as mentioned above. The fire-resistant polyamide constituent of this invention can be manufactured by the approach of corning or pulverizing after melting kneading at a 1 shaft extruder, a multi-screw extruder, a kneader, a Banbury mixer, etc. at the approach of mixing the above components with a Henschel mixer, V blender, a ribbon blender, a tumbler blender, etc., or a mixed backward pan.

[0064] After the electrical and electric equipment and electronic parts of the fire-resistant electrical and electric equipment and <electronic-parts> this invention carry out heating fusion of the fire-resistant polyamide constituent of this invention obtained as mentioned above, they can be made into a desired configuration an allocated type, and they can be manufactured by cooling. In this allocated type, it can manufacture by the approach of carrying out melting shaping of the fire-resistant polyamide constituent of above-mentioned this invention into the metal mold which can form a desired configuration etc.

[0065] And by using the fire-resistant polyamide constituent of this invention, the fluidity of melt shown by light-gage flow length trial is good, and can manufacture efficiently electronic parts, such as a connector which has many thin-walled parts. And electronic parts like the connector manufactured from the fire-resistant polyamide constituent of this invention have high toughness, and a crack etc. cannot generate them easily at the times of junction of a connector (when the terminal of a male connector is inserted in a female mold connector etc.). Moreover, the electrical and electric equipment and electronic parts of this invention have the outstanding thermal resistance, and it is rare to carry out heat deformation also in a reflow solder process.

[0066] Such the fire-resistant electrical and electric equipment and electronic parts of this invention are excellent in fire retardancy and thermal resistance, and its absorptivity is low and excellent also in mechanical strengths, such as toughness.

[0067]

[Effect of the Invention] According to this invention, it excels in fire retardancy and excels also in mechanical properties, such as toughness, and a fluidity can be good and can offer the fire-resistant polyamide constituent which can be used suitable for the electrical and electric equipment and an electronic-parts application. Moreover, according to this invention, the electrical and electric equipment and electronic parts which were excellent in the fire retardancy and thermal resistance which were formed using the above fire-resistant polyamide constituents, and were excellent also in the mechanical property can be offered.



[0068]

[Example] Hereafter, although this invention is explained still more concretely based on an example, this invention is not limited to these examples. an example and the example of a comparison -- setting -- each -- measurement and evaluation of description were performed by the following approaches.

It asked for the endoergic curve of DSC about the <melting point> polyamide, and temperature of the maximum peak location was made into the melting point (T<sub>m</sub>). The endoergic curve stuffed the aluminum pan, and the temperature up of the sample was carried out the rate for 10-degree-C/, and it asked for it.

It measured according to <MFR>ASTM D1238.

[0069] 120 degrees C of pellets are dried under reduced pressure for 12 hours using a vacuum dryer. Next, the automatic extrusion mold plastometer was used and it measured by 2.095mm of orifice bores. In addition, the load and temperature conditions at the time of MFR measurement are as follows.

(A) aromatic polyamide load: -- 2.16kg, measurement temperature:melting point +10 degree-C(C) Pori bromination styrene load:3.8kg, and measurement temperature:230-degree-C<viscosity number> ISO -- it measured based on 307-1984 (E). A polyamide is extracted from a polyamide constituent using 96% of concentrated sulfuric acid, and the concentrated-sulfuric-acid solution of a polyamide with a concentration of 0.005g [ /ml ] is prepared. It measured at 25 degrees C using the viscometer of the Ubbelohde mold of a publication to ISO3105.

Using the test piece with die length of 64mm prepared with <bending test (toughness)> injection molding, a width of face [ of 6mm ], and a thickness of 0.8mm, the bending test was performed by span 26mm and bending rate 5 mm/min, and flexural strength, a bending elastic modulus, the energy (toughness) taken to destroy the test piece, and the amount of distortion when destroying were measured.

[0070] making machine: -- Sodick Co., Ltd. plus tech and TSUPARU TR40S3A cylinder-temperature:NT/C1 / 3= 320 degrees C of C2/C, and 320 degrees C -- product made from /310 degrees C /, and 300-degree-C die-temperature:120-degree-C bending tester:NTESCO It injected on condition that the following to bar flow metal mold with an AB5 <light-gage flow length trial> width of face [ of 10mm ], and a thickness of 0.5mm. 20 shots of the beginning threw away, measured the flow length (mm) of ten shots after that, and asked for the average.

[0071]

injection molding machine: -- IS[ by Toshiba Machine Co., Ltd. ]-55EPN injection-pressure: -- 1000kg/cm2 injection-speed: -- 99% cylinder-temperature: -- 3= 320 degrees C of C2/C, 320 degrees C / [ NT/C1 / ] 310 degrees C / 300-degree-C die-temperature: -- 120-degree-C <fire retardancy> UL94 convention estimates fire retardancy.

[0072]

[Example 1] (A) It uses in the amount which shows each following component in Table 1 as a - (D) component, and the total quantity 100 weight section of (A) - (D) component is received further, as the drip inhibitor at the time of combustion -- mallein-ized SEBS (the Asahi Chemical Co., Ltd. make --) the tough tech M1913 -- as 1 weight section and a halogen catcher -- a hydrotalcite (the product made from Consonance Chemistry --) DHT-4C -- as the 0.3 weight section and a release agent -- a wax (made in Clariant Japan --) as the HOSUTAMONTO NaV101 0.3 weight section and a crystalline-nucleus agent -- talc (the product made from Matsumura Industrial V --) It inserted in the extruder with a 2 shaft vent set as the temperature of 310 degrees C, and melting kneading was carried out, it pelletized [ the high filler #100 HAKUDO 95 0.7 weight section was added, respectively, and it mixed and ], and the polyamide resin constituent of a pellet type was obtained.

(A) Aromatic polyamide presentation : dicarboxylic acid component [ -- 310 degree-CMFR / -- 150g / 10 minutes (it measures at 320 degrees C) ] -- 55 mol % [ of terephthalic acids ], 45 mol % [ of adipic acids ], and diamine component -- 1 6-diaminohexan 100 mol % limiting viscosity [eta] -- 0.8 dl/g melting point

(B) Minerals reinforcement glass fiber (CS03JAFT2made from Asahi fiberglass A)

(C) Pori bromination styrene a bromine content -- 60-% of the weight MFR -- 100g / 10 minutes (load: 3.8kg, measurement temperature:230 degree C)

(D) Multiple oxide sodium antimonate containing the compound containing antimony, and/or zinc (NaSbO<sub>3</sub>)

Subsequently, description was evaluated about the obtained polyamide resin constituent. A result is shown in Table 1.

[0073]

[The examples 1-4 of a comparison] In the example 1, everything but having used Pori bromination styrene b-d of the description shown in Table 1 as a (C) component, respectively manufactured the polyamide resin constituent like the example 1, and evaluated description about the obtained polyamide resin constituent. A result is shown in Table 1.

[0074]

[Table 1]

|                       |              | 実施例 1 | 比較例 1 | 比較例 2 | 比較例 3 | 比較例 4 |
|-----------------------|--------------|-------|-------|-------|-------|-------|
| (A)成分 (重量%)           |              | 4 0   | 4 0   | 4 0   | 4 0   | 4 0   |
| (B)成分 (重量%)           |              | 3 0   | 3 0   | 3 0   | 3 0   | 3 0   |
| (C)成分<br>(重量%)        | 臭素化アクリル a    | 2 5   |       |       |       |       |
|                       | 臭素化アクリル b    |       | 2 5   |       |       |       |
|                       | 臭素化アクリル c    |       |       | 2 5   |       |       |
|                       | 臭素化アクリル d    |       |       |       | 2 5   |       |
|                       | 臭素化アクリル e    |       |       |       |       | 2 5   |
| (C)成分<br>性状           | 臭素含量 (重量%)   | 6 0   | 5 9   | 6 4   | 6 4   | 6 0   |
|                       | MFR          | 1 0 0 | 2 8   | 5 7   | 1 0 4 | 5 1   |
| (D)成分 (重量%)           |              | 5     | 5     | 5     | 5     | 5     |
| 組<br>成<br>物<br>性<br>状 | 曲げ強度 (MPa)   | 2 1 0 | 2 3 0 | 2 3 0 | 2 2 0 | 2 1 0 |
|                       | 曲げ弾性率 (MPa)  | 11700 | 11900 | 12000 | 12200 | 11600 |
|                       | 破壊エネルギー (mJ) | 3 8   | 4 2   | 4 2   | 3 7   | 3 7   |
|                       | 重量 (mm)      | 3. 2  | 3. 4  | 3. 4  | 3. 2  | 3. 2  |
|                       | 薄片流動長 (mm)   | 8 0   | 7 0   | 6 9   | 7 6   | 7 3   |
|                       | 粘度数          | 9 4   | 9 4   | 9 3   | 9 3   | 9 4   |
|                       | 難燃性          | V-0   | V-0   | V-0   | V-0   | V-0   |

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[Translation done.]